Comparing
OAM Transport Options

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Outline

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  - Security
  - Overhead
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Scope

- **Current three-part objective states:**
  - **Support far-end OAM for subscriber access networks:**
    - **Remote Failure Indication**
    - **Remote Loopback**
    - **Link Monitoring**
- **Work continues defining 'what' information will be carried over OAM transport**
- **This presentation focuses on 'how' OAM transport mechanisms compare**
  - **OAM in Preamble**
  - **OAM in Frames**

Backwards compatibility

- Deliberately restricting our work to exclude existing Ethernet technologies is not a virtue
- OAM defined in EFM should be applied to
  - legacy links, at 10, 100 and 1000 Mbps
  - future Ethernet links including 10 Gigabit Ethernet

- OAM in Preamble needs to deal with all preamble constraints across all speeds
- OAM in Frames supports all speeds

Security

- Concerns about DoS attacks and authentication apply equally to both transport mechanisms
- OAM messages are confined to a single link
  - They are not forwarded or routed
- A node must be subverted in either case to generate bogus OAM messages

- Security issues are best left to upper layers

Overhead

- OAM in Preamble transports messages out-of-band
  - That is, when user traffic exists to carry OAM messages
  - When no normal frames are sourced from MAC, RS sends dummy frames
- OAM in Frames transports messages in-band
  - OAM bandwidth could be made configurable
- Other management traffic is regularly sent in-band for such functions as topology discovery, address resolution, statistics (i.e. SNMP, TFTP, ARP, ping, etc)

Bandwidth

Speed	OAM in Preamble		OAM in Frames
	Line-rate min frames	Line-rate max frames	
10000	29.8 Mb/s	1.61 Mb/s	Configurable
1000	2.98 Mb/s	161 Kb/s	Configurable
100	298 Kb/s	16.1 Kb/s	Configurable
10	29.8 Kb/s	1.61 Kb/s	Configurable

Flexibility

- OAM in Frames is flexible and expandable
  - For instance, OAM can be configured for basic or advanced link monitoring
    - MAC level:
      - Tx/Rx Pkts
      - CRC errors
    - PCS/PMA level:
      - Cu : SNR, Corrected Error
      - P2P: 8B10B symbol errors
      - P2MP: 8B10B symbol errors, upstream access control monitor
    - PMD level:
      - Cu: Tx Power, AGC gain
      - P2P: Loss of Signal (Rx power)
      - P2MP: Loss of Signal (Tx/Rx) power

Commonality

- **OAM in Frames offers:**
  - **Protocol commonality**
    - **Same operation regardless of link speeds and/or network topology.**
  - **Implementation commonality**
    - **Frame generation resides above the MAC**
    - **Does not require different implementation concepts for different PHYs**

Side-by-side comparison

Property	OAM in Preamble	OAM in Frames
Backwards Compatibility	No	Yes
Security	Same	
Overhead	Near zero	Yes, configurable
Bandwidth	Tied to link speed, traffic	Configurable
Flexibility	Tied to link speed, traffic	Yes
Commonality	May require different concepts for different PHYs	Yes
Implementation	Hardware	Firmware
Complexity	Moderate	Simple

Other Issues

- OAM in Preamble requires changes to the RS
  - Most if not all implementations of MACs incorporate the RS
  - A change to the RS is, for all practical purposes, a change to the MAC
- OAM in Preamble dummy frames do not make sense
  - Real frames impacted when dummy frames are sent
  - Architecturally impure
    - Duplicates functionality that belongs and already exists in MAC

Summary

- **Several advantages of OAM in Frames significantly outweigh the lone out-of-band benefit of OAM in Preamble**
- **OAM in Frames common usage and configurable performance across EFM and legacy 802.3 links an important factor**